15 Years of Information Systems Design Science Research: A Bibliographic Analysis

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Abstract

The publication of the seminal work of Hevner et al. [34] generated a noticeable shift on the part of researchers, leading to greater interaction between research and practice, in particular through the development of Information Systems Design Science Research (ISDSR). Fifteen years later, the time appears ripe for a retrospective analysis of this research paradigm in order to understand the logic and dynamics of its development.

Recently, a small number of researchers have attempted to provide such an analysis through literature syntheses based on their subjective interpretation of the field. We seek to pursue this effort through a Co-Citation Analysis of ISDSR articles published in the AIS basket of eight journals. As such, we offer an original analysis of the ISDSR literature that sheds light on its intellectual foundations. Our contribution is twofold. First, we show the distribution of ISDSR articles and the composition of the intellectual core. Second, we discuss our quantitative results and identify an integrative framework for ISDSR.

1. Introduction

In recent years, a new way of engaging in research, namely Information Systems Design Science Research (ISDSR), has developed. ISDSR has its roots in the pioneering article of Nunamaker et al. [46], which introduced the idea of using systems development as a research methodology. At the same time, Walls et al. [64] defined a prescriptive information systems (IS) design theory to enable designers to construct "more effective information systems" [64:36]. To these authors, the term "design" is both a noun and a verb. Design theory must thus encompass both a product and a process. Information systems design theory accordingly refers to an integrated prescription comprising a specific class of user requirements, a systems solution with a set of system features, and a design methodology to guide the development process. The other aspect of Design Science Research (DSR) is that the development of the IT / IS artifact must be deeply rooted in science. Here, design process and design product are two sides of the same coin. The design process is made by iterative build-and-evaluate loops [34], which provide feedback information to improve the quality of both the product and the design process. These two design activities rely on existing kernel theories [34]. In this sense, the design embodies principles from the theories [64]. The design process thus starts with requirements derived from kernel theories and hypothesized design and development principles that meet these requirements. On the basis of these hypothesized principles, it becomes possible to specify system features.

Later, based on March and Smith's [40] distinction between behavioral and design science, the well-known article of Hevner et al. [34] defined ISDSR using seven guidelines. Their article is the most cited ISDSR paper and, as such, largely crystallized the thinking about this paradigm. A few years later, Hevner [32] clarified the three inherent design cycles of any DSR, namely the relevance, rigor, and design cycles. Drawing on these guidelines, Peffers et al. [51] proposed a more precise DSR methodology. Their ambition was to strengthen the initial developments and propose a common framework that researchers could use to conduct and evaluate DSR.

ISDSR has gained in credibility over the years. Gregor & Hevner recently stated that ISDSR "has staked its rightful ground as an important and legitimate Information Systems (IS) research paradigm" [30:337]. An ISDSR community has emerged and is now actively engaged in scientific activities through a dedicated conference created in 2006 (Design Science Research in Information Systems and Technology – DESRIST) and recurring tracks at international conferences such as HICSS and other AIS conferences. Moreover, a growing number of ISDSR articles are published in high-quality IS journals such as those of the AIS basket of eight journals. These articles employ numerous different DSR guidelines, rules, and frameworks. Although the ISDSR approach is now considered to be a "research paradigm", we agree with prominent ISDSR authors when they recognize that the field still needs to mature [30] [50]. Some key authors of the ISDSR literature have recently tried to overcome these issues. Gregor & Hevner [30] first proposed reconciling what could be

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interpreted as two distinct DSR camps, namely a design-theory camp [31][41][65] and a pragmatic-design camp [46][40][34]. More recently, Peffers et al. [50] conducted an interpretive review of DSR articles published in the AIS basket of eight journals to identify prototype genres of DSR. Each genre defines "its contribution differently and evaluates prospective contributions accordingly, has its own expectations for methodology, and has its own presentation style and minimum requirements" [50:130].

However, these studies do not provide an exhaustive analysis of the ISDSR literature. Each corpus of references analyzed relies on the authors' subjective choices in function of their own subjectivities and research interests. Although these insights are relevant and useful for the ISDSR community, and although 15 years have now passed since the publication of the seminal paper by Hevner et al. [34], it nonetheless appears that the ISDSR literature lacks an exhaustive and retrospective analysis explaining the underlying logic of its development.

In this article, we seek to fill this gap with a co-citation analysis of ISDSR [26] [57], a relevant and alternative literature review methodology [66] that helps to identify patterns of publication [3] and to shed light on the intellectual traditions of a research field. We employ an explorative approach of the literature in order to identify the intellectual core [45] and invisible colleges [17] of the ISDSR articles published in the AIS basket of eight journals. The main research question that guides our analysis is as follows: What are the intellectual groundings of ISDSR and how do they contribute to the construction of a consistent field of research?

The question is important for IS design science researchers and other IS researchers who may adopt this methodological approach. The identification of the most cited and co-cited ISDSR publications in top IS journals reveals the theoretical bases on which the approach has developed over time. As such, our study's description of different DSR perceptions may help researchers to familiarize themselves with this methodological approach and to position their works accordingly. Our study could thus help researchers to better understand and apply adequate ISDSR patterns and guidelines, and help reviewers to correctly receive and evaluate ISDSR projects.

Our results show that the ISDSR literature is deeply rooted in the IS discipline legacy and does not significantly mobilize DSR traditions from other disciplines such as organization studies. We identify five invisible colleges that have their own role and contribution in the development of different ISDSR methodological perspectives. Finally, to explain this heterogeneity of ISDSR approaches, we provide an integrative framework, i.e. a two-axe diagram that distinguishes epistemological reflections on ISDSR from their ISDSR translations on the one hand, and idiographic research from nomothetic research on the other.

The paper is organized as follows. First, we introduce the co-citation analysis (CCA) approach and describe our data collection and treatment. Second, we detail our results and discuss their contribution to the ISDSR community.

2. Methodology and data

Bibliometric analysis is one of the three literature review methods available to researchers [66]. The most common method is the traditional systematic literature review. Researchers define and follow a formal procedure to collect and interpret a corpus of documents [68]. This approach is frequently subject to researchers' bias and a lack of rigor [61]. The second method is the quantitative meta-analysis of the literature [27]. This approach aims to determine overall trends by comparing the results of quantitative studies. By definition, it excludes all qualitative research and essays from the analysis. Bibliometrics [26][58] is the third method that may be used to analyze a literature stream in depth. It is based on quantitative techniques such as clusterization and mapping to "catalog, classify and quantify knowledge in a given discipline" [25:112]. It provides a graphic and synthetic representation of a research corpus by highlighting structures of recurring citation patterns. Researchers can use these patterns to show, evaluate, and track the evolution of a research field or sub-field [72]; to reveal its theoretical foundations (e.g. in IS: [18][19]); or to identify concept-, theory-, or model-building processes (e.g., the Strategic Alignment Model: [52]). Although the interpretive literature review and bibliometric approaches have typically been opposed, Walsh and Renaud [66] argue that they are neither exclusive nor antinomic. They can be used in a complementary manner since the interpretive approach puts "qualitative flesh on quantitative bones" [60]. Conversely, the statistical treatment of aggregated bibliometric data helps researchers to manage the complexity of a large corpus of scientific publications.

In this paper, we use bibliometrics to analyze the emergence and development of DSR in the IS field. Four commonly used bibliometric methods exist in the bibliometrics literature [72]: citation and co-author analysis, co-citation analysis (CCA), bibliographic coupling (BCA), and semantic analysis. Each method relies on its own principles and has its own potential. Of these, CCA appears to be the most suitable with respect to our research objective.

CCA is designed as a means with which to investigate the so-called intellectual core of a research set, i.e. the references that are the most used by, and relevant for, the literature [45]. It also helps to identify invisible colleges, i.e. groups of regularly co-cited documents that belong to the same research tradition [17][58]. They reveal the theoretical underpinnings and the key assumptions on which the investigated literature is developed. As these outcomes are particularly relevant to our research goals, we employed CCA as a means of investigating the ISDSR literature.

CCA involves analyzing references cited in a set of scientific publications [12]. It considers the most influential references from a corpus of research and investigates their relationships. Two documents are considered to be co-cited by an author when the author cites them simultaneously [57]. CCA relies on two assumptions: the repeated citation of a pair of articles demonstrates their complementarity [12]; and researchers who co-cite the same references share the same representation and perspective of their research domain [57]. The similarity between two references in a selected area of scholarship is then measured by their frequency of co-citation [43].

We followed a three-step process to perform the CCA: (1) data collection; (2) data processing; and (3) data interpretation (see results and discussion).

2.1. Data collection

In CCA, data collection is twofold. We first need to identify the body of research to be investigated. The sole criterion here is that the query needs to correspond to the research project. From this first-order sample, we collect all the cited references and isolate the most cited documents/authors that constitute the so-called "intellectual core" [45]. In this article, we aim to identify the intellectual foundations underpinning the DSR literature that has been developed on IS. To do this, we collected data from two sources. First, we searched the Scopus database to retrieve all articles that cite "design framework", "design research", "design principle", "design rules", "design science", or "design theory" in their title, abstract, or keywords and that were published in the AIS basket of eight journals (European Journal of Information Systems; Information Systems Journal; Information Systems Research; Journal of Information Technology; Journal of Management Information Systems; Journal of Strategic Information Systems; Journal of the Association of the AIS; and MIS Quarterly). To consolidate our database, we analyzed the abstracts and removed articles not directly related to DSR. The final set is composed of 192 articles (8,547 single references). Our choice of the AIS basket of eight journals was motivated by the fact that, although these journals represent only 8% of the IS journals identified in various international rankings (Harzing and CNRS), they publish more than 22% of the articles on DSR[1]. Moreover, despite criticisms of such lists [13], these journals are the most specific, recognized, and influential journals in the community [15] and they are regularly investigated by empirical studies on IS research [3][15].

We collected bibliographic data from Scopus. As there is no common standard for citing references in scientific journals, we had to clean the data by standardizing the citations in order to accurately compute their occurrence.

Once the data had been collected and cleaned, we had to identify the second-order sample, in other words the intellectual core of the DSR literature. It is neither possible nor relevant to analyze more than 7,000 references. To define the intellectual core, the first step was to compute the citation frequency for each reference. The higher the frequency, the more central the reference is for the literature. Nonetheless, establishing the citation threshold used to delineate the intellectual core is a key issue since it influences the final research output. Some of the required mathematical rigor needs to be abandoned in favor of an extended interpretive perspective [58]. As Renaud et al. [52:79] stated, "the definition of the thresholds has to be processed through trial and error, striking a balance between statistical relevance and the significance of resulting data". The larger the intellectual core, the more exhaustive the analysis will be. However, this exhaustiveness increases the risk of statistical noise and interpretation issues. Conversely, the smaller the intellectual core, the higher the statistical relevance, which also restricts literature coverage.

In this study, we identified two thresholds, corresponding to two intellectual cores (Table 1). We then compared the invisible colleges of these two intellectual cores and concluded that a threshold level of 10 (i.e. 45 references) made more sense for our analysis. This sample size is consistent with standard bibliometric studies [7][22][43][42], i.e. between 30 and 50 articles.

2.2. Data processing

In CCA, the data analysis is conducted on the intellectual core. Co-citation frequencies are computed

[1] On Scopus, we identified 822 DSR articles published in the 98 IS journals referenced by two journal rankings (Harzing and CNRS).

in order to cluster documents to highlight the invisible colleges [58][45][17].

To analyze the bibliographic data, we used VosViewer 1.6.9. [67][23], a bibliometric freeware developed by researchers from Leiden University that includes every step of the analysis of large datasets, from the identification of the intellectual core to the visual mapping of the results. This tool automates the procedure while also enabling researchers to make choices about thresholds or the normalization method. Following Van Eck & Waltman [23], we normalized the data using the association strength method. The software uses the Louvain algorithm [11] to cluster the data and provides a graph-based map. The more important a document is, the larger its node and label will be. The stronger the link between two documents, the thicker the connecting line will be. Colors indicate the cluster to which a document has been assigned by the algorithm.

3. Findings

3.1. Descriptive analysis

Figure 1 provides a breakdown of the source of the 192 articles included in this review and shows the distribution of these publications across years.

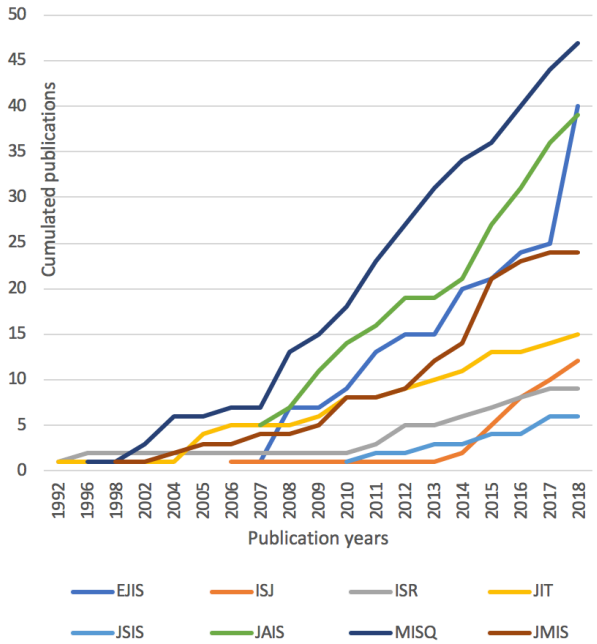

Figure 1. Publication trend in the AIS basket of eight journals

As Figure 1 shows, most of the ISDSR articles are published in four of the AIS basket of eight journals i.e. MISQ, EJIS, JAIS, and JMIS. This figure also indicates that there has been strong growth in publications since 2010, highlighting that DSR has gained ground in the IS literature.

The intellectual core represents the set of references that ISDSR literature relies on for its development, enabling authors to legitimize their studies and provide a rationale for their research. Table 2 presents an overview of the ISDSR intellectual core composition and specifies the cluster or invisible college to which each reference belongs (1st column), the number of citations of each item (#cit), and the percentage citation of an item by the whole sample (%). The intellectual core of the literature published in the AIS basket of eight journals is a mix of items grounded in different research backgrounds (Type). Although the majority belong to the IS-DSR type (22 references out of 45, i.e. 49% of the sample), we also observe that researchers cite references dealing with general IS issues (GEN-IS: 9 out of 45 – 20%), references oriented toward methodological debate (METH: 11 out of 45 – 24%), and references from other fields (GEN: 2 out of 45 – 4%). It appears that only one reference from the DSR literature in organization studies (ORG-DSR) has been sufficiently cited by ISDSR researchers to form part of the intellectual core.

The composition of the intellectual core confirms the existence of a strong ISDSR community that shares common references. It is organized around different, but complementary, theoretical and methodological perspectives. However, this community is self-centered in the sense that it ignores a whole design science literature based on organization and management research (Pascal, 2012). Indeed, in these disciplines, new forms of engaged scholarship in which researchers and practitioners co-produce knowledge have also emerged since the 1990s (Van Aken, 2005; Van de Ven and Johnson, 2006; Romme and Endenburg, 2006).

In the following subsection, we present our results pertaining to the ISDSR invisible colleges.

3.2. ISDSR invisible colleges

Figure 2 provides an overview of the five invisible ISDSR colleges. Hevner et al. [34] is the key reference, belonging to a cluster were ISDSR guidelines are central. Most of the other clusters have tied links with this cluster but each provides a specific contribution to the ISDSR literature.

Cluster 1. Qualitative methodological foundations (Red – 12 items)

This cluster is composed of references that discuss the status of theory [29] and the contribution of qualitative methodologies, both in IS [38] [8] and in management

[71][44][24]. More specifically, in the IS field, the dominant foundation research perspective is questioned in terms of its ability to deal with situated interactions [49][47][37]. In this line of research, Benbasat & Zmud [9] insist on the necessity of developing new approaches to overcome the issue of IS research relevance. As such, this cluster shows that a substantial number of authors anchor DSR in a qualitative case study approach. Reference to work by Schön [54] opens the way toward greater interaction between researchers and practitioners. Other references help DS researchers to justify the adequacy of the IS discipline with design science [35] and to ensure the rigor of the knowledge produced, beyond the IS dominant foundations [29].

Cluster 2. Reflections on the IS discipline (Blue – 9 items)

This cluster is composed of references that investigate the artificial component of the IS discipline and the complexity of situations encountered by IS researchers. As such, Cluster 2 attempts to position ISDSR in the larger context of ISR and science more generally. Weick [69] considers that theorizing is more an artificial selection than a natural one. Checkland [14] attempts to avoid the reductionism of natural science by making sense of system thinking. Benbasat & Zmud [10] argue that IT artifacts or IS systems should be brought to the forefront in the IS discipline, noting that they have long been treated as a black box. The reference to Simon's [56] definition of a science of the artificial logically appears in this cluster. DS researchers agree on the merits of anchoring ISDSR in Simon's [56] definition of a science of the artificial. Although all DS researchers share the common legacy of Simon's science of the artificial, they adopt different epistemological perspectives that influence the way they identify and conceive the research problem, and the way they design and evaluate the artifact produced. It is interesting that two references from two opposite perspectives emerge, one favoring nomothetic knowledge and embracing the idea of technological determinism [53][63][20], the other favoring an emergent and non-determinist view achieved with idiographic studies [39].

Cluster 3. IS design theory (Yellow – 7 items)

This cluster is composed of seven core ISDSR articles. The works of March & Smith [40] paved the way for the emergence of design science as a new methodological approach in IS research. They addressed the issue of designing IT artifacts and proposed a design science perspective, in contrast to a natural science perspective. CCA also suggests that the core concept at the center of research on DSR is the development of IS design theory [62]. This is consistent with Orlikowski & Iacono [48], who call for theorizing regarding IT artifacts. In this perspective, Walls et al. [64] and Walls et al. [65] develop an IS design theory. To justify this positioning, DS researchers refer to Van Aken [2], who focuses on how to build design rules with kernel theories in the discipline of organization studies. Markus et al. [41] is a typical empirical work that develops an IS design theory.

	Reference	#cit	%	Type
1	Benbasat & Zmud (1999)	10	5%	GEN-IS
1	Benbasat et al. (1987)	10	5%	METH
1	Eisenhardt (1989)	13	7%	METH
1	Gregor (2006)	40	21%	IS-DSR
1	Iivari (2007)	25	13%	IS-DSR
1	Klein & Myers (1999)	14	7%	METH
1	Lee & Baskerville (2003)	12	6%	METH
1	Miles & Huberman (1994)	12	6%	METH
1	Orlikowski & Baroudi (1991)	10	5%	GEN-IS
1	Orlikowski & Scott (2008)	10	5%	GEN-IS
1	Schön (1983)	12	6%	METH
1	Yin (2013)	27	14%	METH
2	Benbasat & Zmud (2003)	16	8%	GEN-IS
2	Checkland (1981)	10	5%	GEN-IS
2	Davis (1989)	13	7%	GEN-IS
2	Kuhn (1970)	10	5%	METH
2	Leonardi (2011)	11	6%	GEN-IS
2	Rogers (1995)	13	7%	GEN
2	Simon (1969)	64	33%	IS-DSR
2	Venkatesh et al. (2003)	14	7%	GEN-IS
2	Weick (1989)	11	6%	GEN
3	March & Smith (1995)	63	33%	IS-DSR
3	Markus et al. (2002)	46	24%	IS-DSR
3	Orlikowski & Iacono (2001)	35	18%	GEN-IS
3	Vaishnavi & Kuechler (2004)	11	6%	IS-DSR
3	Van Aken (2004)	16	8%	ORG-DSR
3	Walls et al. (1992)	72	38%	IS-DSR
3	Walls et al. (2004)	14	7%	IS-DSR
4	Baskerville & Myers (2004)	11	6%	METH
4	Cole et al. (2005)	10	5%	IS-DSR
4	Davison et al. (2004)	11	6%	METH
4	Goldkuhl (2012)	10	5%	IS-DSR
4	Sein et al. (2011)	38	20%	IS-DSR
4	Susman & Evered (1978)	11	6%	METH
5	Abbasi & Chen (2008)	10	5%	IS-DSR
5	Baskerville & Pries-Heje (2010)	14	7%	IS-DSR
5	Gregor & Hevner (2013)	43	22%	IS-DSR
5	Gregor & Jones (2007)	59	31%	IS-DSR
5	Hevner (2007)	20	10%	IS-DSR
5	Hevner & Chatterjee (2010)	10	5%	IS-DSR
5	Hevner et al. (2004)	140	73%	IS-DSR
5	Kuechler & Vaishnavi (2012)	10	5%	IS-DSR
5	Nunamaker et al. (1991)	37	19%	IS-DSR

5	Peffers et al. (2007)	46	24%	IS-DSR
5	Winter (2008)	12	6%	IS-DSR

Table 2. The ISDSR intellectual core

introduce the idea of using IS development methodologies as research methodologies. Abbasi & Chen [1] is a typical empirical work applying these guidelines.

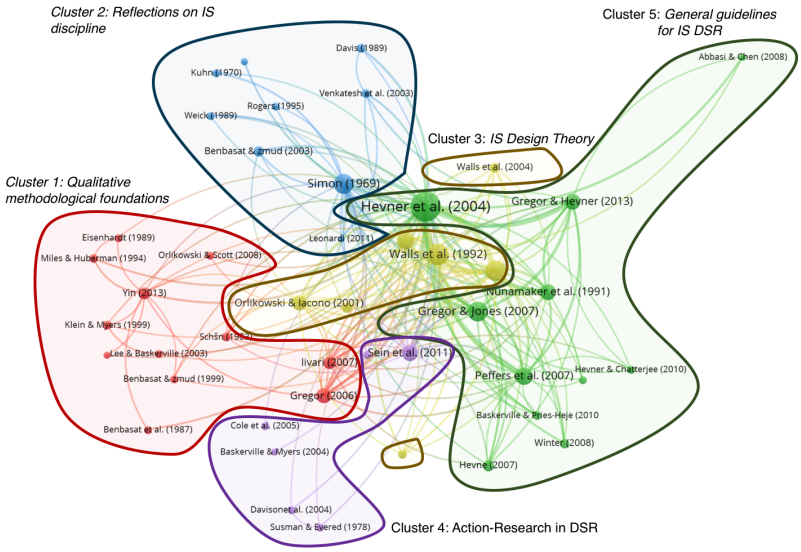

Figure 2. ISDSR literature's invisible colleges

Cluster 4. Action research in IS DSR (Purple – 6 items)

The articles in this cluster are related to action research. The seminal works of Cole et al. [16] and Sein et al. [55] introduced an action-research-oriented approach to DSR. Researchers involved in this stream of research justify their methodological positioning by co-citing pure action research contributions in the IS [4][55] and general management disciplines [21][59]. These methodological issues raise epistemological questions and a pragmatic positioning, as defined by Goldkuhl [28], appears to be preferred by the DSR literature.

Cluster 5. General guidelines for ISDSR (Green – 11 items)

This cluster comprises the most cited references in the DSR literature (see Table 2), notably because it aggregates articles that propose DSR guidelines. Hevner is the central author in ISDSR. Indeed, Hevner et al. [34] is the first and most cited publication. It is followed by other works that specify design cycles (rigor, relevance, and design – [32]), a general framework for DSR [33], and specific guidelines for publishing DSR articles [30]. Other authors propose alternative guidelines for conducting ISDSR [50][70][5] and for conceiving design theories [31]. All of the references build on the legacy of Nunamaker [46], who was the first to

4. Discussion and expected contributions

The publication of the seminal work of Hevner et al. [34] generated a noticeable shift on the part of researchers, leading to greater interaction between research and practice through the development of ISDSR. This has led to a profusion of DSR definitions and genres of inquiry. Recently, several authors have proposed literature syntheses to identify and characterize these different approaches. Gregor & Hevner [30], for example, emphasize that DSR projects may produce different research contributions depending on their starting points in terms of problem maturity and solution maturity. Iivari [36] attempts to identify two DSR strategies that can be contrasted along 16 dimensions. Baskerville et al. [6] also consider design-science research activity. They recognize the "multigenre nature of the design-science research" and that design-science study is composed of different knowledge moments. They develop four genres of inquiry that may help DS researchers to correctly justify and evaluate their studies.

Although these articles clarify the diverse purposes and methodological models of ISDSR, they fail to explore the fundamental core of the ISDSR literature. They highlight the multi-nature of ISDSR and its implications for justifying the validity of a study, but they do not explore ISDSR's roots and how its anchoring may explain this multi-nature characteristic.

Moreover, these literature reviews are subject to authors' subjectivity, since they select their particular corpus and interpret it through a specific lens according their own interests and research positionings. In this article, we analyzed all the DSR articles published in the AIS basket of eight journals and used quantitative techniques to obtain a graphic and synthetic representation of the ISDSR corpus. In line with Walsh and Renaud [66], our analysis complements previous works that try to take a high-level view of design science research by clarifying its theoretical groundings and the research foundations from which it has emerged and developed.

Our CCA reveals five interrelated invisible colleges. Each college makes a specific contribution to the definition of ISDSR. Cluster 1 anchors ISDSR in a more general IS methodological debate where the nature of the IS discipline is discussed in depth. The references acknowledge that qualitative research could contribute to the production of rigorous scientific theories. This critical approach of the dominant quantitative research perspective is one of the common grounds for researchers intending to adopt a design perspective. These references paved the way for the development of the ISDSR approach and we identify four types of contributions that we organize along two axes. The first axis distinguishes references that are focused on epistemological debates vs. references that can be described as their ISDSR direct translations. The second axis is a continuum between two scientific approaches, one privileging more idiographic research and the other nomothetic research.

Figure 3 gives an overview of this integrative perspective.

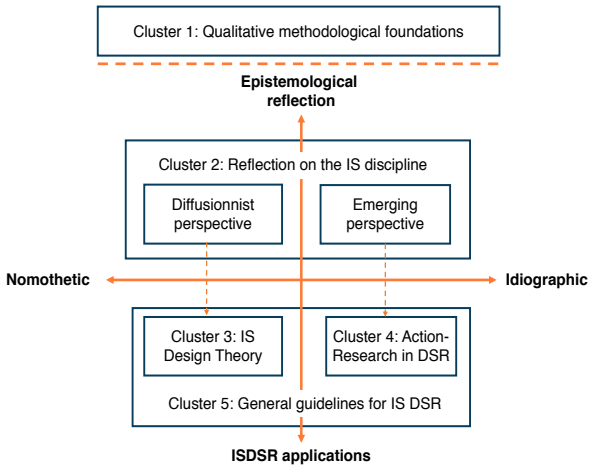

Figure 3. ISDSR invisible colleges: an integrative framework

ISDSR is inscribed as the legacy of Simon's [56] science of the artificial, which recognizes and legitimizes the design of artifacts that solve practical issues as a full-fledged and rigorous scientific activity (Cluster 2). Although artifact is at the core of ISDSR, it could be considered through two divergent lenses that correspond to the main IS literature divergences: a human agency perspective and a technological-oriented perspective [48]. Cluster 2 allows us to identify two divergent philosophical foundations, one favoring a more determinist view of the IT artifact and recognizing nomothetic knowledge, the other favoring a non-determinist view of the IT artifact and recognizing idiographic knowledge.

The existence of references from these two approaches may logically influence the way ISDSR is conceived and applied by researchers. Interestingly, Clusters 3 and 4 also represent different views of ISDSR. Cluster 3 contains references that develop a strong focus on IS design theory. According to Baskerville et al. [6], it is possible to distinguish a nomothetic view of design from an idiographic one. "Nomothetic design can be expressed as more generalizable design theories (Walls et al. 1992) or general design principles that are applicable to a class of problems (Markus et al. 2002)" [6: 2015]. We can hypothesize here that some of the researchers who develop nomothetic design (Cluster 3) may be influenced by the prevalent IS diffusionist perspective where researchers seek to develop generalized knowledge. Another alternative view is that researchers mobilize these nomothetic science works to develop IS design theory, meaning that these works could be perceived as more rigorous.

Conversely, some ISDSR authors propose an action design research perspective (Cluster 4) that has common features with the emerging perspective. As they consider the relationship between IT and organizations to be inscribed in a specific context, they favor idiographic research, that is to say, specific and contingent research that attempts, notably in a critical realist perspective, to find causal powers. Finally, in function of their inclusion in one or other of these approaches, the authors focus on specific points of the different generic ISDSR guidelines (Cluster 5).

To conclude, this framework is useful because it allows us to revisit existing typologies, for example by replacing each of the identified genres of inquiry of Baskerville et al. [6] or the two ISDSR strategies defined by Iivari [36]. The framework could thus be used as a basis with which to replace substantial ISDSR works (even if we agree with the idea of a knowledge moment [6], ISDSR generally prioritizes one objective). The framework may also help ISDSR authors to better

understand the implicit ideas of the different guidelines and, accordingly, to better position their research.

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